

A Test Framework for Movement of Monte Carlo Data Using SAM SRM Interface

1 Introduction

In this document, we are summarizing the results that have been obtained while transferring of data between the Storage Resource Managers (SRMs). We considered two different cases.

1. Files transferred from SRMs at FNAL to UCSD. Both the SRMs are dCache based.
2. Files transferred from SRMs at FNAL to INFN CNAF, Italy. At INFN-CNAF, SRM is StoRM based.

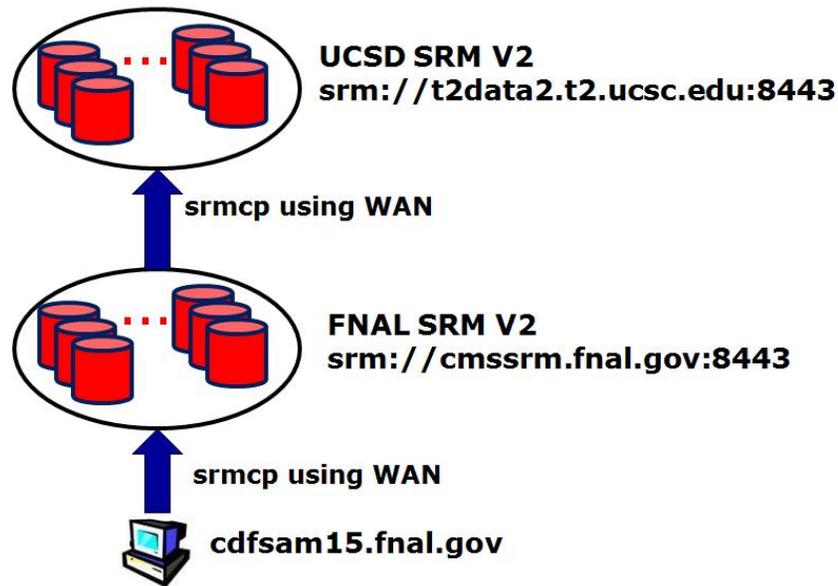
2 Framework

A test framework has been setup for movement of data between Storage Element(SE) at Fermilab and UCSD. Both the SE are being managed by dCache based SRM. Figure 1(a) shows the implementation of the framework. The following SEs have been used for setting up the framework.

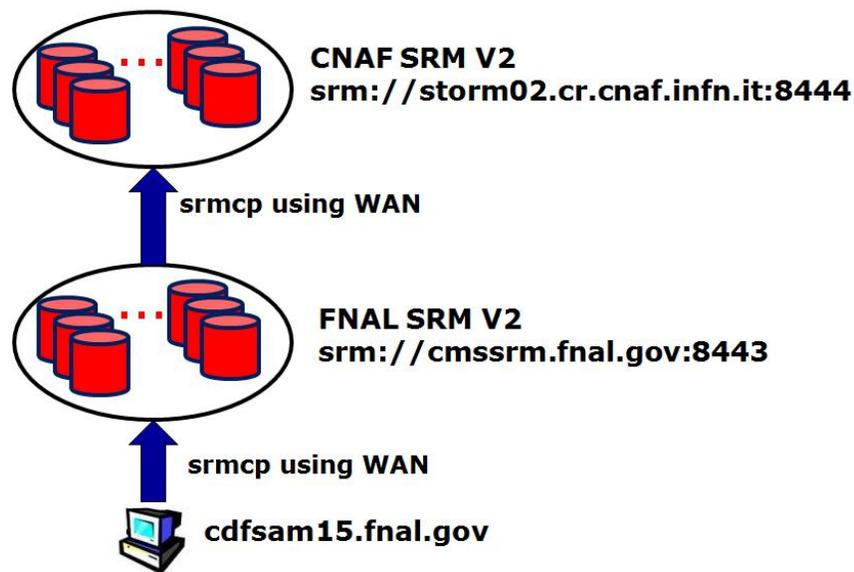
1. dCache managed SRM at Fermilab: “srm://cmsrm.fnal.gov:8443/srm/managerv2?SFN=/resilient/NONCMS_GUEST_30DAYLIFETIME/cdfguest/McData/”
2. dCache managed SRM at UCSD: “srm://t2data2.t2.ucsd.edu:8443/srm/managerv2?SFN=/pnfs/sdsc.edu/data2/cdf/McData/”

A process is running on the cdfsam15.fnal.gov which create dummy files of random sizes and transfer the files to SRM at FNAL using srmcp. This process generates 10 dummy files of random sizes. A cron job is being run at regular interval of time (15 minutes) for continuous creation of files. A different process is running on “cdfsam15.fnal.gov” for transfer of file from SRM at FNAL to SRM at UCSD. The following steps are involved between transfer of file between the two SRMs.

1. List the files available in the SRM folder at FNAL.



(a) From SRM at Fermilab to SRM at UCSD



(b) From SRM at Fermilab to SRM at INFN-CNAF

Figure 1: A test framework for movement of data between the SRMs.

2. Pick a file from the list (say A).
3. Get a TURL(Transfer URL) corresponding to A . It is basically a gsiftp string.
4. Note the start time for copying of file A in the log file.
5. Copy the file A using srmcp between the SRM at FNAL and UCSD. We used all the default options of srmcp. At UCSD, the data is buffered through 3 heavy-duty grid ftp servers on WAN. Each grid ftp servers allows 50 streams per client.
6. When the file A is successfully transferred
 - Print the file name, size, start and end time for copying of file A in the log file.
 - Delete the file A from SRM at FNAL when it is successfully transferred in SRM at UCSD.
7. Go to the step 1 and repeat rest of the steps until all the files in the list is being transferred to SRM at UCSD.

A cron job is running which runs the copy process from FNAL to UCSD SRM at regular interval of time. In this document, we are summarizing the results for which the files transfer continuously takes place for a week between the two mentioned storage elements(SEs).

A similar setup as above has been done for transfer of files between SRMs at FNAL and INFN-CNAF. The SRM at INFN-CNAF is StoRM based managed SRM. Following are the details of the SEs.

1. dCache managed SRM at Fermilab: “srm://cmssrm.fnal.gov:8443/srm/managerv2?SFN=/resilient/NONCMS_GUEST_30DAYLIFETIME/cdfguest/McData/”
2. StoRM managed SRM at INFN-CNAF: “srm://storm02.cr.cnaf.infn.it:8444/srm/managerv2?SFN=/cdf/McData/”

Type	File Size (fsize)
A	$\text{fsize} \leq 10 \text{ MB}$
B	$10 \text{ MB} < \text{fsize} \leq 100 \text{ MB}$
C	$100 \text{ MB} < \text{fsize} \leq 1 \text{ GB}$
D	$1 \text{ GB} < \text{fsize} \leq 2 \text{ GB}$
E	$2 \text{ GB} < \text{fsize} \leq 3 \text{ GB}$
F	$\text{fsize} > 3 \text{ GB}$

Table 1: Different categories of files based on its size.

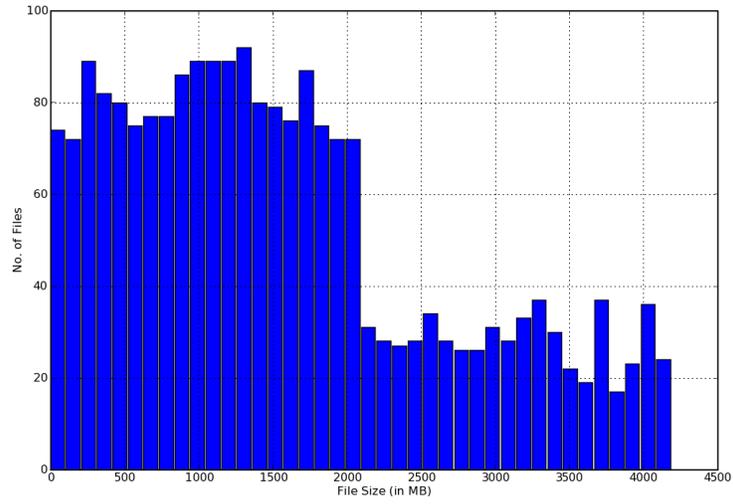
In this case, the file is being moved in another folder of SRM at FNAL once it get successfully transfer to SRM at CNAF. In the previous case, the file was deleted from the SRM at FNAL(step 6).

2.1 Composition of Files

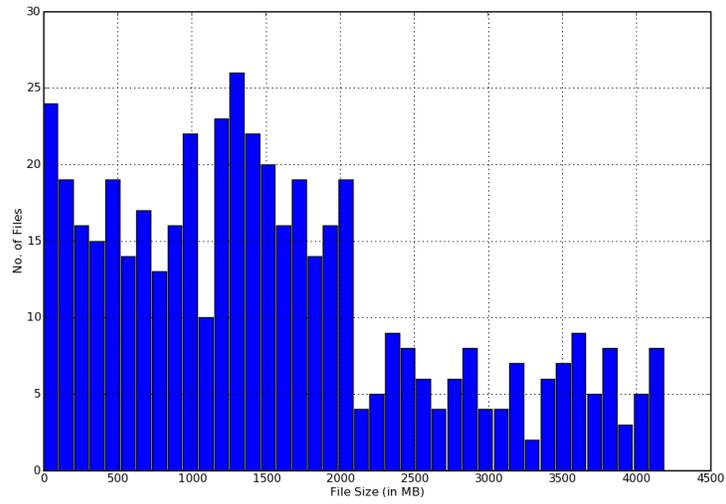
We have used dummy files of random sizes. The random number generator has been biased intentionally for generating file sizes of larger values. The dummy files have been generated in size from few Mega bytes (MB) to 4 Giga bytes (GB). Figure 2 shows the generated dummy files in bins of 100 MB. For the comparison purpose, the dummy files have been divided on the basis of its sizes into different categories. Table 1 list the different categories of the dummy files based on its sizes. Figure 3 shows the composition of files used for testing the framework.

3 Monitoring Parameters

In the following sections, we are showing some parameters that will help us in evaluating the performance of the framework.

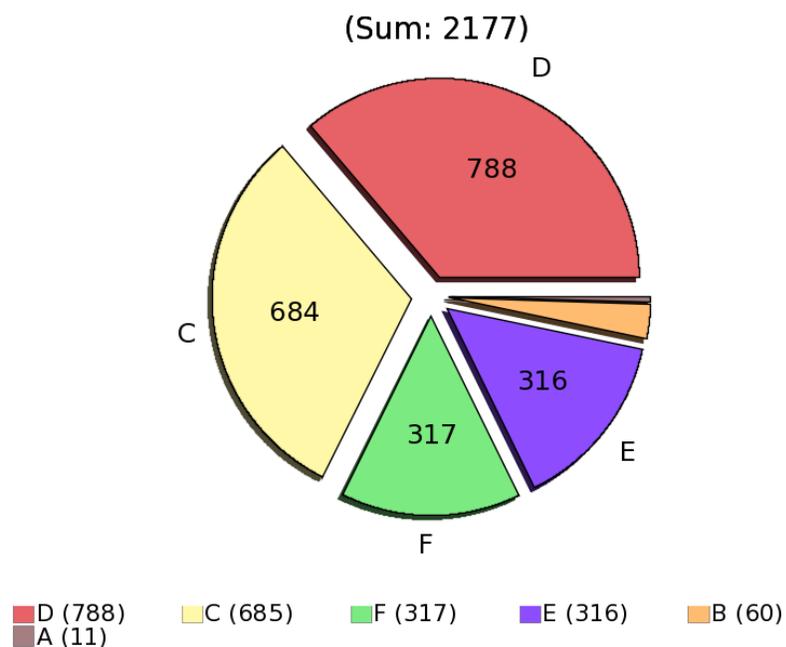


(a) For transfer of files between SRMs at Fermilab and UCSD

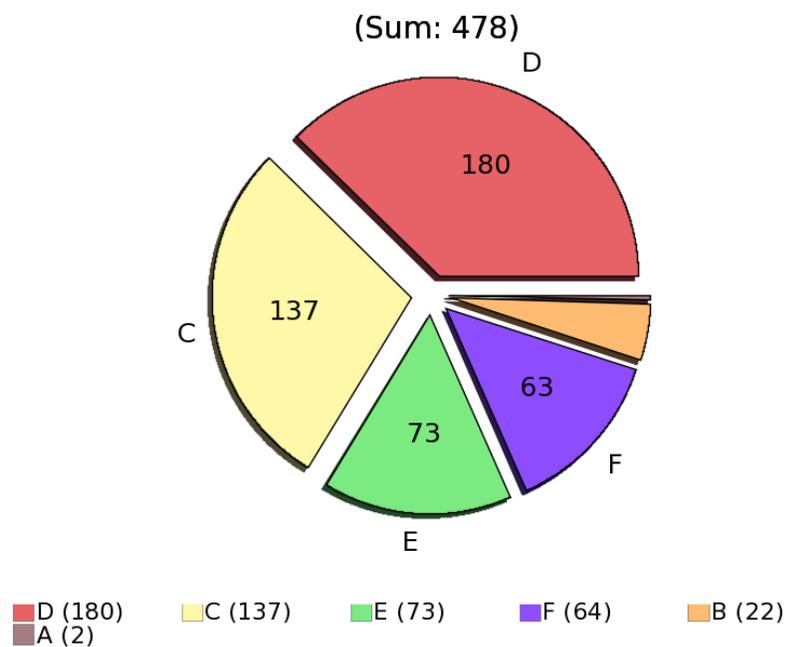


(b) For transfer of files between SRMs at Fermilab and CNAF

Figure 2: Distribution of file size.



(a) For transfer of files between SRMs at Fermilab and UCSD



(b) For transfer of files between SRMs at Fermilab and CNAF

Figure 3: Composition of files which are used for transfer between two SRMs. The numbers in the pie chart indicate the number of files being generated in the particular category.

3.1 Transfer Time

Figure 4 shows the time needed for copying of files between the SRMs. SRM initialization time for dCache is of the order of around 10 seconds which can be seen from the transfer time needed for file types A and B in Figure 4(a). It is also clear from the figure that transfer time increases proportionally with the file size. In file type C of Figure 4(a), there is a band of structure in transfer time and it may be due to fluctuations in the network performance. These fluctuations are not visible in other file types D and F of Figure 4(a) due to larger scales.

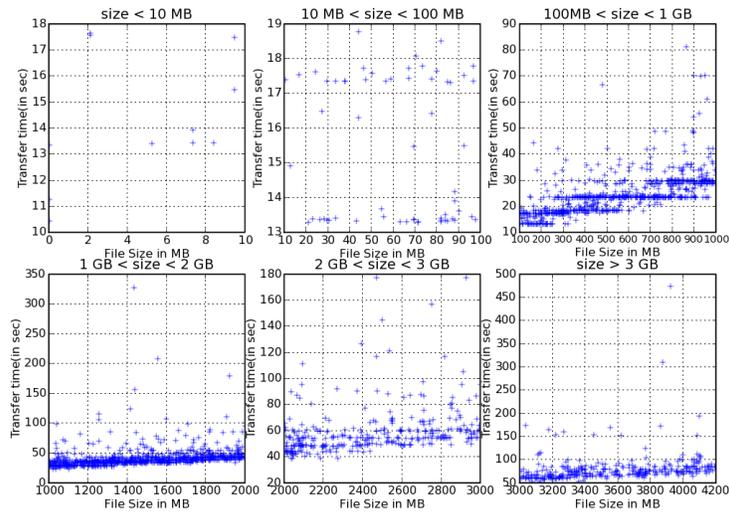
3.2 Transfer Rate

Figure 5 shows the transfer rates for different types of file between SRMs. It is evident from the figure that transfer rate increases with file size up to certain extent. In Figure 5(a), there also exist a band in transfer rate and it may be due to day to day fluctuations in network performance. The output of user analysis job will fall in the file type B while that of MC jobs lie in C and D. In these cases, the file transfer rate continuously increases with file size.

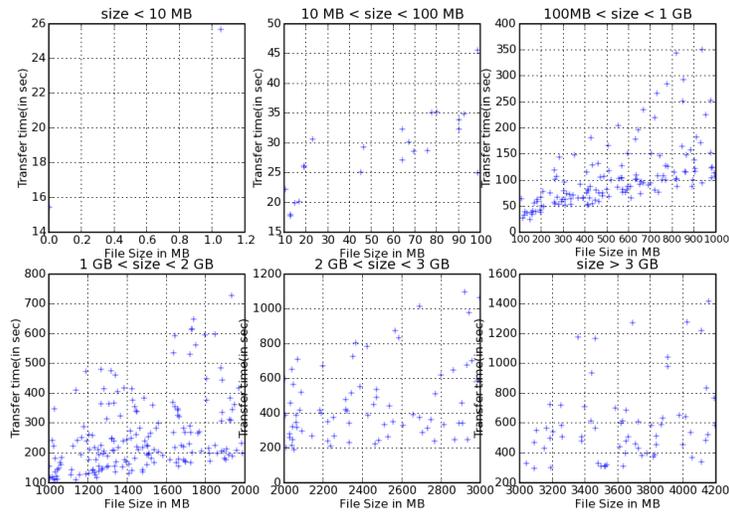
A qualitative comparison between transfer time and its rate can be seen from the Figures 6. The numbers in the left and right hand side of the pie-chart represent the average transfer time and rate for each category of the file types respectively. A quantitative comparison can be made between transfer time and rate for different file types. For example, the transfer time for file type A is larger in comparison to its transfer rate while for file types D and E, it is opposite.

3.2.1 Latent time

In Figure 7, we tried to show the amount of time being not used(latent) in transfer of the files in the framework. In transferring file from SRM at Fermilab to UCSD, the major latency include deletion of files from SRM at Fermilab (after successful copy of the previous file in the list at UCSD) and getting transfer URL(TURL) for the next

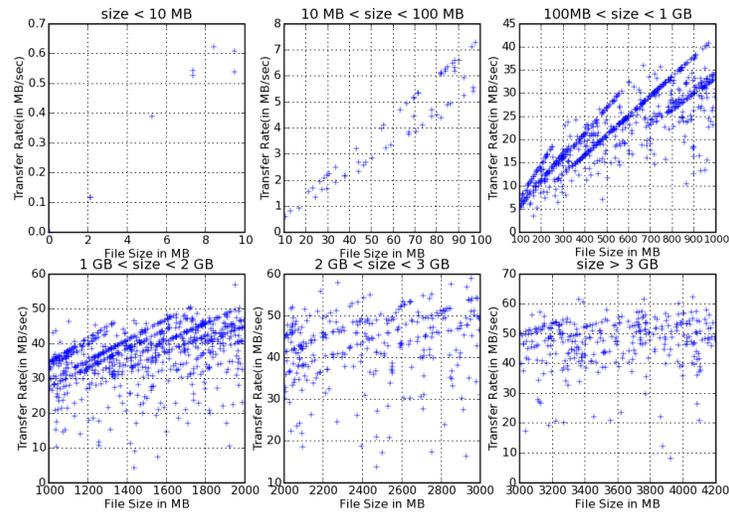


(a) For transfer of files between SRMs at Fermilab and UCSD

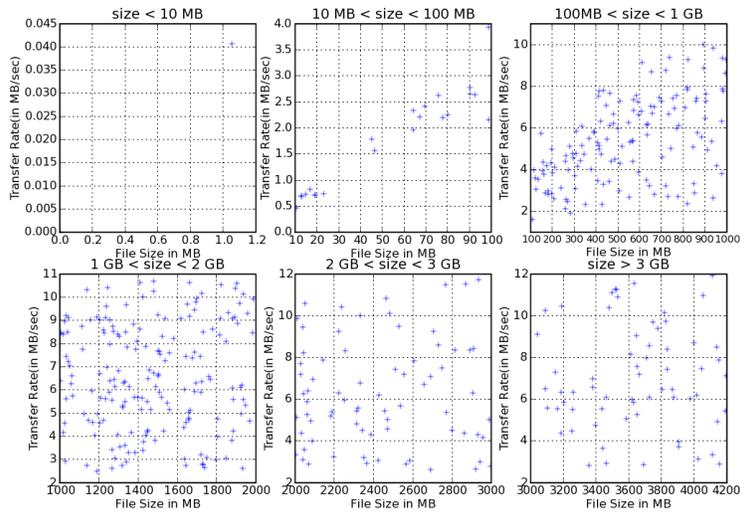


(b) For transfer of files between SRMs at Fermilab and CNAF

Figure 4: Time taken by different categories of files for copying between SRMs.

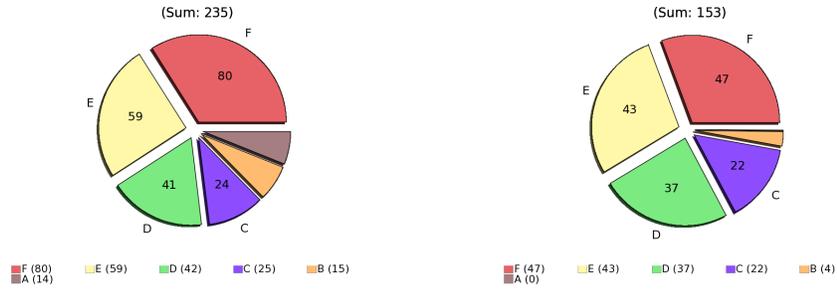


(a) For transfer of files between SRMs at Fermilab and UCSD



(b) For transfer of files between SRMs at Fermilab and CNAF

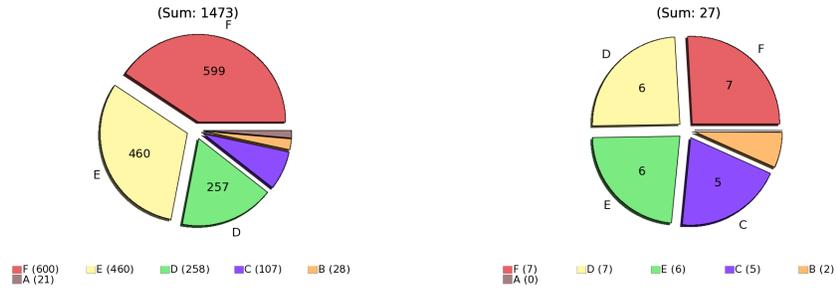
Figure 5: Transfer rate for different categories of files.



(a) Transfer time.

(b) Transfer rate.

For transfer of files between SRMs at Fermilab and UCSD



(c) Transfer time.

(d) Transfer rate.

For transfer of files between SRMs at Fermilab and CNAF

Figure 6: A qualitative comparison between transfer time and rate.

file. Figure 8 estimates the average latency involved in each consecutive transfer for different file types. Figure 7(b) shows the latent time for all files are same except for the file type E. For file type E, one of the file has taken time of the order of around 5000 seconds (Figure 7(b)) and hence the average has been shifted to higher value.

3.2.2 Cumulative Flow of Data

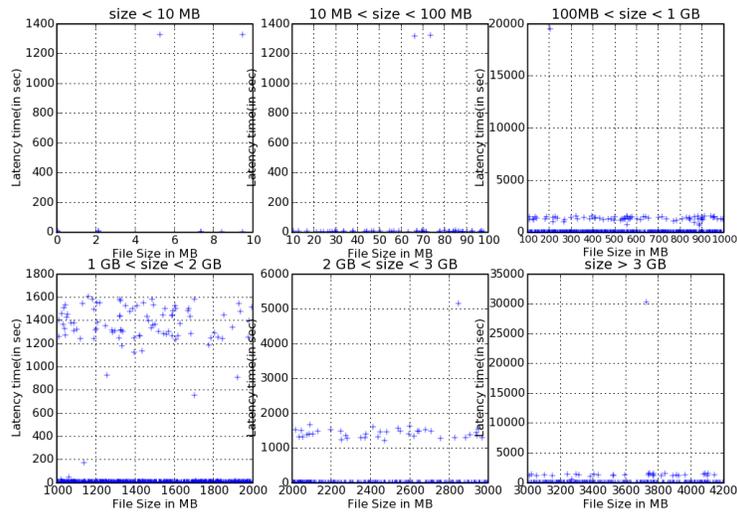
Figures 9 and 10 shows the amount of data which can be transported between SRMs per hour and day respectively. Around 25GB/hr and 600 GB/day amount of data can be transported using wide area network(WAN) between SRMs at FNAL and UCSD.

4 Future Plan

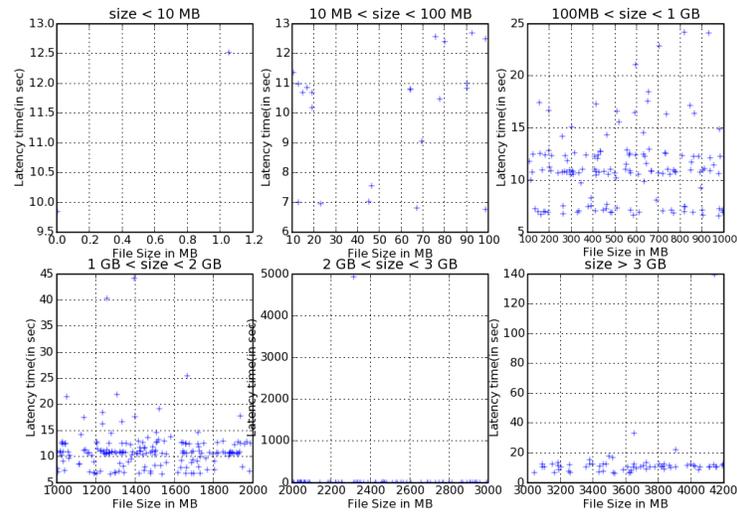
We will test the framework in which a single job contains many files to transfer and also study the efficiency as function of number of jobs.

Acknowledgment

We would like to thanks Jon Bakken from FNAL, Abhishek Rana and Frank Wuertwein from UCSD, Luca Dell’Agnello and Elisabetta Ronchieri for providing space on SRM.

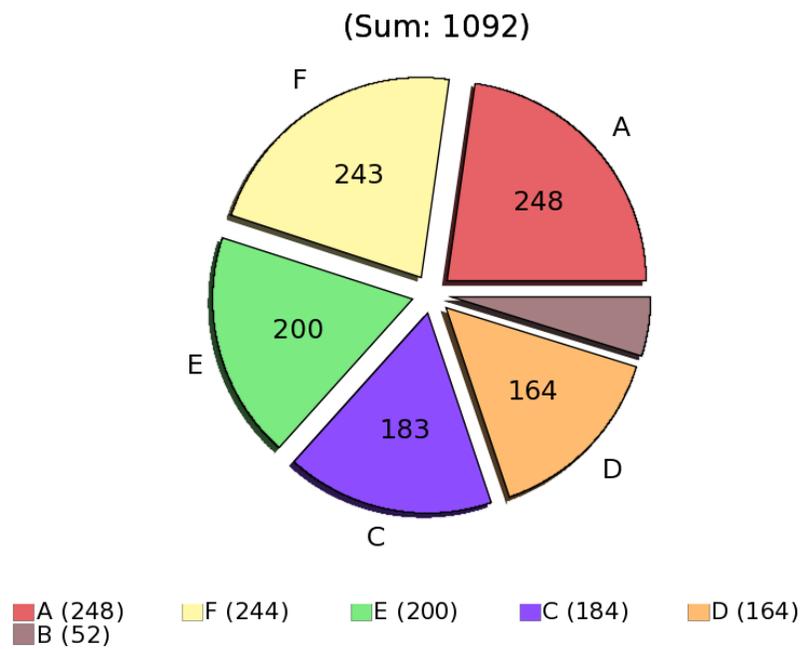


(a) For transfer of files between SRMs at Fermilab and UCSD

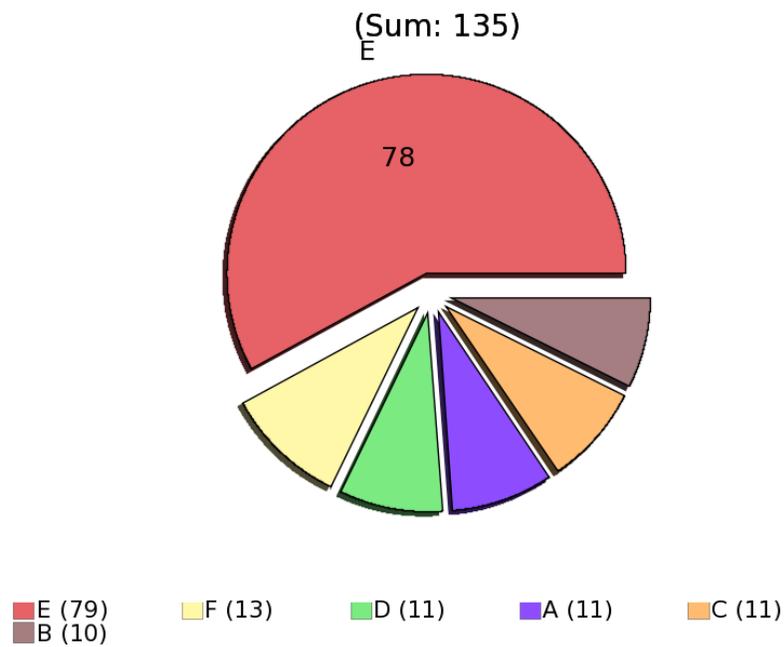


(b) For transfer of files between SRMs at Fermilab and CNAF

Figure 7: Latent time involved in each consecutive transfer between SRMs.

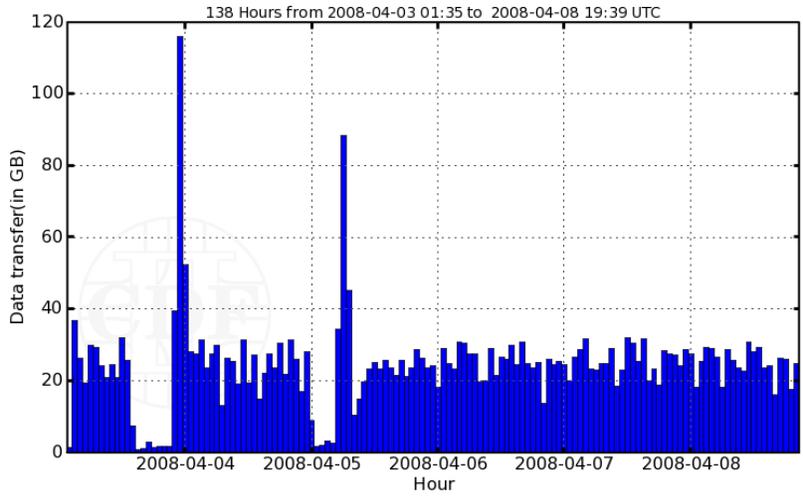


(a) For transfer of files between SRMs at Fermilab and UCSD

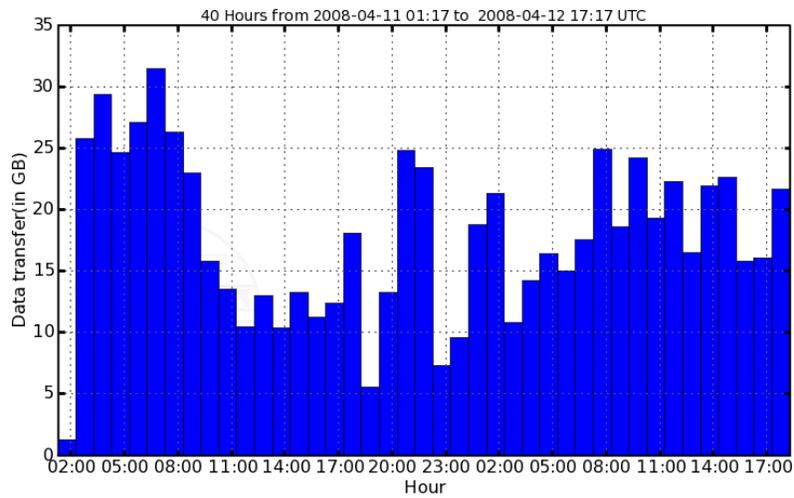


(b) For transfer of files between SRMs at Fermilab and CNAF

Figure 8: Latent time involved in each consecutive transfer between SRMs.

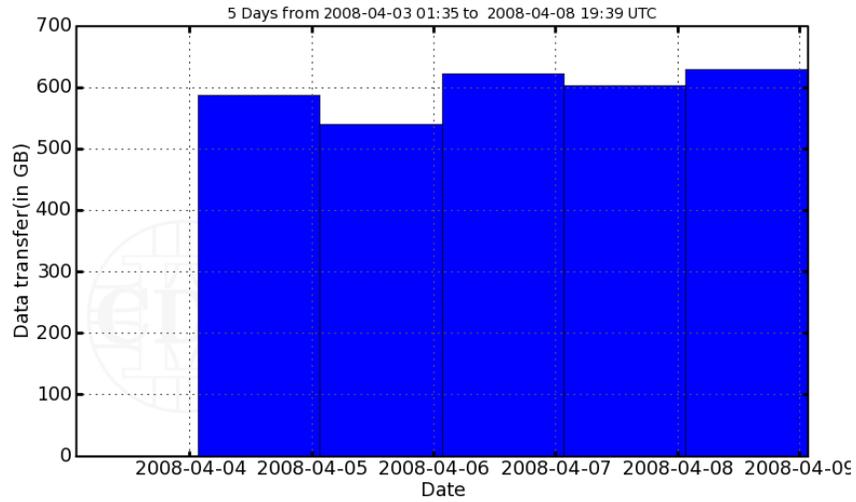


(a) For transfer of files between SRMs at Fermilab and UCSD

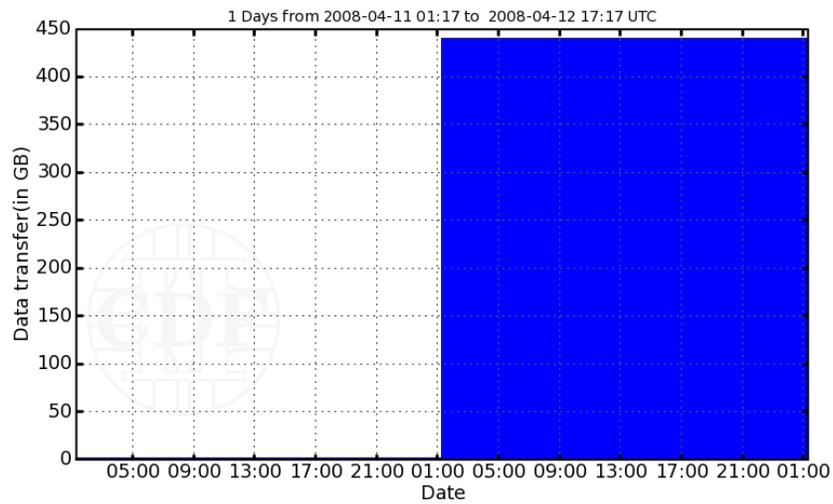


(b) For transfer of files between SRMs at Fermilab and CNAF

Figure 9: Amount of data which can be transported per hour between SRMs.



(a) For transfer of files between SRMs at Fermilab and UCSD



(b) For transfer of files between SRMs at Fermilab and CNAF

Figure 10: Amount of data which can be transported per day between SRMs.